
Logistics Management Institute

Comparison of Navy and Private-Sector Construction Costs

NA610T1

September 1997

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DEFENSE QUALITY INSPECTOR 4

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Chapter 1

Introduction

Each year, the Department of the Navy, through the Naval Facilities Engineering Command (NAVFAC), contracts for military construction (MILCON) projects at a cost exceeding \$2 billion. Congressional committees and Navy customers have expressed concern about whether the costs of facilities constructed under NAVFAC contracts are comparable to private-sector construction costs.

To address this concern, NAVFAC tasked the Logistics Management Institute to compare Navy construction costs with those of the private sector.¹ This report conveys the results of that comparison. Chapter 2 describes the methodology we used to ensure that our comparisons were valid. In particular, we wished to ensure that we analyzed comparable types of facilities and that we properly accounted for the additional costs of complying with federal contracting requirements as compared with the costs of similar projects completed under typical private-sector contracts. Chapter 3 presents our findings, primarily in the form of graphs, and our conclusions.

¹ The Institute conducted a similar study in 1984 for the Department of Defense. In that study, we compared DoD construction costs with construction costs incurred by private, federal government, and state and local government owners. See Logistics Management Institute, *Military Versus Private Sector Construction Costs*, William B. Moore and Joseph S. Domin, December 1984.

Chapter 2

Methodology

Our approach to comparing Navy and private-sector construction costs was to analyze new construction award costs per square foot. To derive construction costs per square foot, we compiled a database of 62,112 construction projects from a database published by F.W. Dodge, a division of McGraw-Hill Companies. The Dodge database captures 99 percent of all new construction projects in the United States; for each project, it contains such data as facility category, contract award cost, total square footage, and type of owner (private, federal government, and state or local government). We also obtained a database from NAVFAC; it contained 280 valid construction projects.

To ensure that we analyzed comparable types of projects and that we properly accounted for cost variations resulting from geographic, size, and other differences, we took the following steps:

- ◆ Identified categories of Navy facilities likely to have private-sector counterparts
- ◆ Mapped categories of facilities in the Dodge database to comparable Navy categories
- ◆ Compiled projects to be analyzed
- ◆ Categorized the projects by owner type: Navy, private, federal government, and state or local government
- ◆ Normalized the cost of each project to account for regional price differences, size differences, and inflation
- ◆ Adjusted the construction costs of private-sector projects upward to account for the additional costs of complying with federal contracting requirements as compared with the costs of similar projects completed under typical private-sector contracts
- ◆ For each project, calculated the construction cost per square foot and conducted statistical analyses.

The following sections provide additional detail about our methodology.

FACILITY CATEGORIES

Table 2-1 lists the Navy facility categories that we selected for analysis. We chose those categories because they comprise facilities that are generally similar—in terms of construction type and requirements—to facilities found in the private sector, and they account for a significant portion of the Navy MILCON program. The table also lists the categories of facilities that we identified from the Dodge database as being comparable to the Navy categories.

Table 2-1. Mapping of Dodge Facility Categories to Navy Facility Categories

Navy facility category (and code)	Dodge facility category
Administrative facilities (61010)	Office buildings—1–3 stories Office buildings—4+ stories Banks—1–3 stories Banks—4+ stories
Bachelor enlisted quarters (721XX)	Hotels/motels—1–3 stories Hotels/motels—4+ stories Hotels/motels—number of stories unknown Dormitories
Child development centers (74074)	Special schools
Family housing (71XXX)	Single-family houses Two-family houses Apartment buildings—3 or 4 units Apartment buildings—5+ units, 1–3 stories
Fitness centers (74043)	Gyms/field houses YMCAs/YWCAs Miscellaneous recreational facilities
Laboratories (31XXX)	Laboratories
Training facilities (171XX)	Vocational schools Community colleges Colleges/universities Armories

PROJECT DATABASE

In our database, we included

- ◆ all projects from the Dodge database awarded between 1992 and 1995 and larger than 1,000 square feet (we eliminated smaller projects because we assumed that they were modifications or additions rather than new construction) and

- ◆ all new construction projects awarded by the Navy from FY87 through FY95, located in the 50 United States, and included in any of the seven facility categories. (We included 9 years' worth of Navy projects to ensure that we had a reasonable sample size for analysis.)

Table 2-2 shows the number of projects in our database for each facility category.

Table 2-2. Number of Projects in Database by Facility Category and Owner

Facility category	Navy	Projects in F.W. Dodge database			
		Private	Federal	State or local	Total
Administrative facilities	25	19,704	244	1,169	21,117
Bachelor enlisted quarters	69	2,277	93	161	2,531
Child development centers	19	995	60	231	1,286
Family housing	11	30,090	99	793	30,982
Fitness centers	5	2,382	149	1,442	3,973
Laboratories	25	509	125	229	863
Training facilities	126	555	97	708	1,360
Total	280	56,512	867	4,733	62,112

COST ADJUSTMENTS

We normalized each project award cost by applying three adjustment factors: a cost index to account for regional price differences, an inflation factor to normalize the project costs to a base of 1997 dollars, and a DoD size factor to normalize project costs based on their relative square foot size. Each adjustment factor is described in Appendix A.

We applied a fourth adjustment factor to private-sector project costs only. Specifically, we increased private-sector costs by 16 percent so that they would be more directly comparable to Navy costs. That percentage reflects the additional cost of complying with federal contracting construction clauses, such as the Davis-Bacon Act, and restrictive federal technical and material specifications. In other words, the typical project constructed under a federal government contract costs approximately 16 percent more than a similar project constructed in the private sector because of the additional administrative effort needed to comply with federal contracting requirements and other extra costs. Table 2-3 shows the percentage increase in construction costs for different categories of contract clauses. The percentages were derived from the results of a recent survey

conducted by the Institute in conjunction with the American Consulting Engineers Council.¹

Table 2-3. Percentage Increase in Construction Costs Attributed to Federal Government Contracting Requirements (median)

Category	Estimated cost increase (percent)
Social action clauses	3
Cost control and accountability clauses	3
Business protection clauses	1
Labor statute clauses	6
Other requirements (restrictive technical and material specifications)	3
Total	16

ANALYSES

After adjusting the Navy and Dodge project costs, we calculated each project's cost per square foot. We then analyzed the data to establish the median, mean, and range of costs for each facility category and for each type of owner: Navy, private, private adjusted (for federal clause compliance), federal government, and state or local governments.

¹ Logistics Management Institute, *Impact of Federal Government Contracting Requirements on Design and Construction Costs: Survey Results*, Report NA610RD1, Jordan W. Cassell, Robert D. Campbell, and Paul D. Jung, October 1996.

Chapter 3

Findings and Conclusions

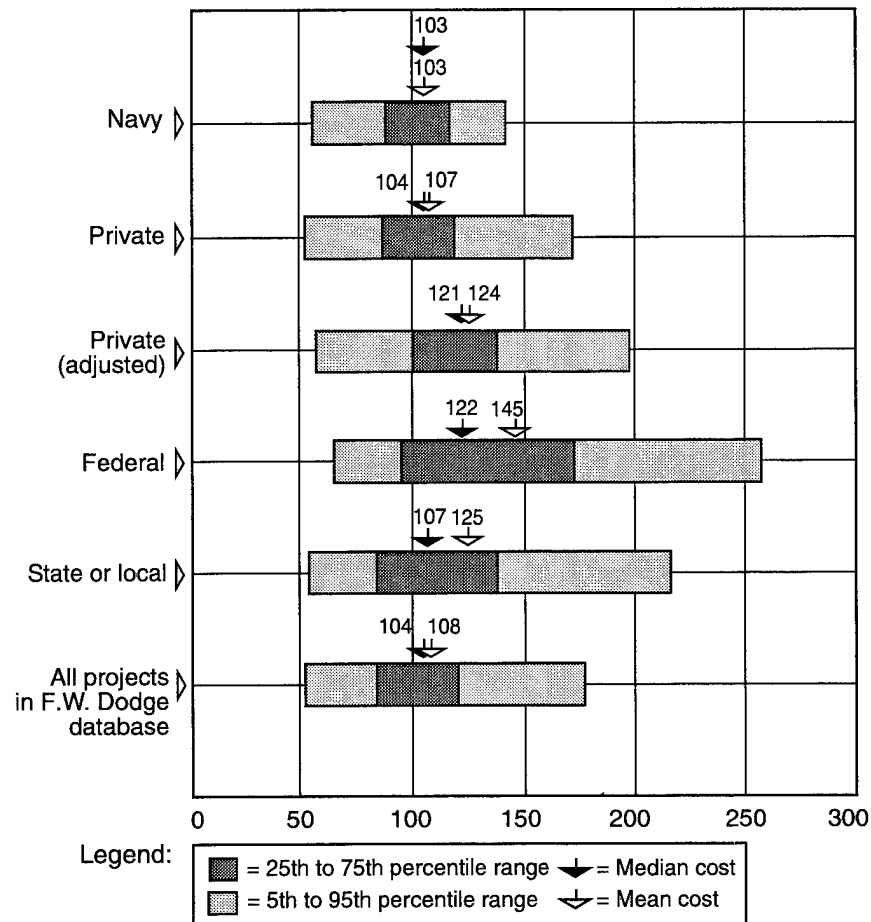
FINDINGS

The results of our analyses are depicted in Figures 3-1 through 3-7. Each figure covers a different facility category and shows, for each type of owner, the full range of costs (from the 5th percentile to the 95th percentile) and the typical range of costs (from the 25th percentile to the 75th percentile). It also shows the median and mean construction costs incurred by each type of owner.

Administrative Facilities

Figure 3-1 compares the construction costs of administrative facilities. The construction costs of Navy administrative facilities are directly comparable to those of private-sector administrative facilities and lower than those of administrative facilities owned by other federal agencies and by state and local governments.

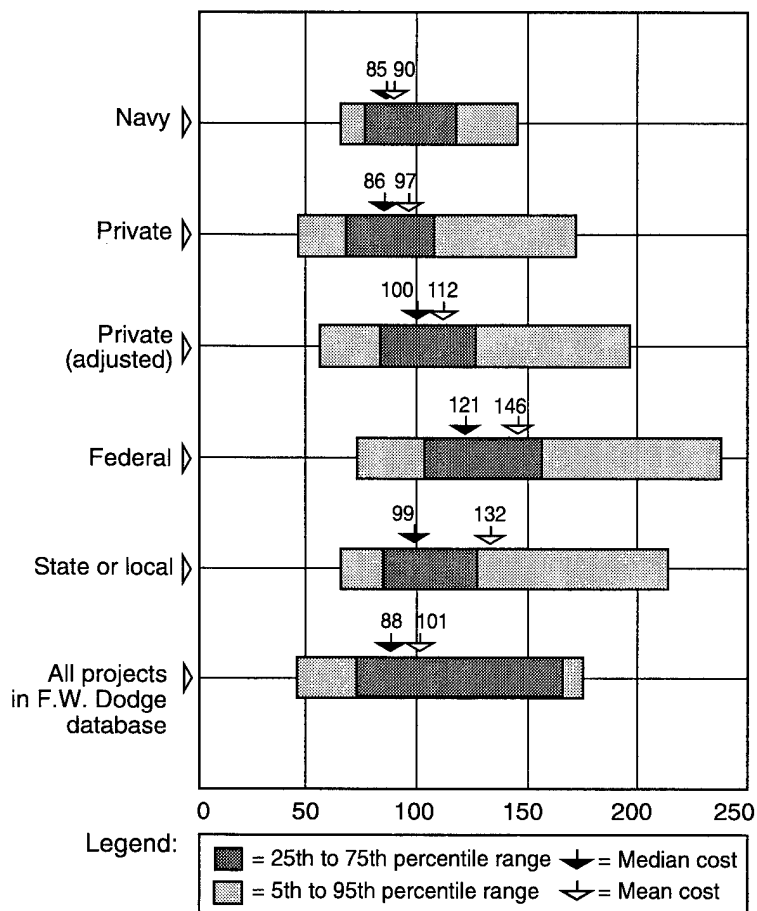
*Figure 3-1. Construction Costs of Administrative Facilities
(FY97 dollars per square foot)*



Bachelor Enlisted Quarters

Figure 3-2 compares the construction costs of BEQs. The construction costs of Navy BEQs are directly comparable to those of similar facilities built by the private sector and lower than those of facilities owned by other federal agencies and by state and local governments.

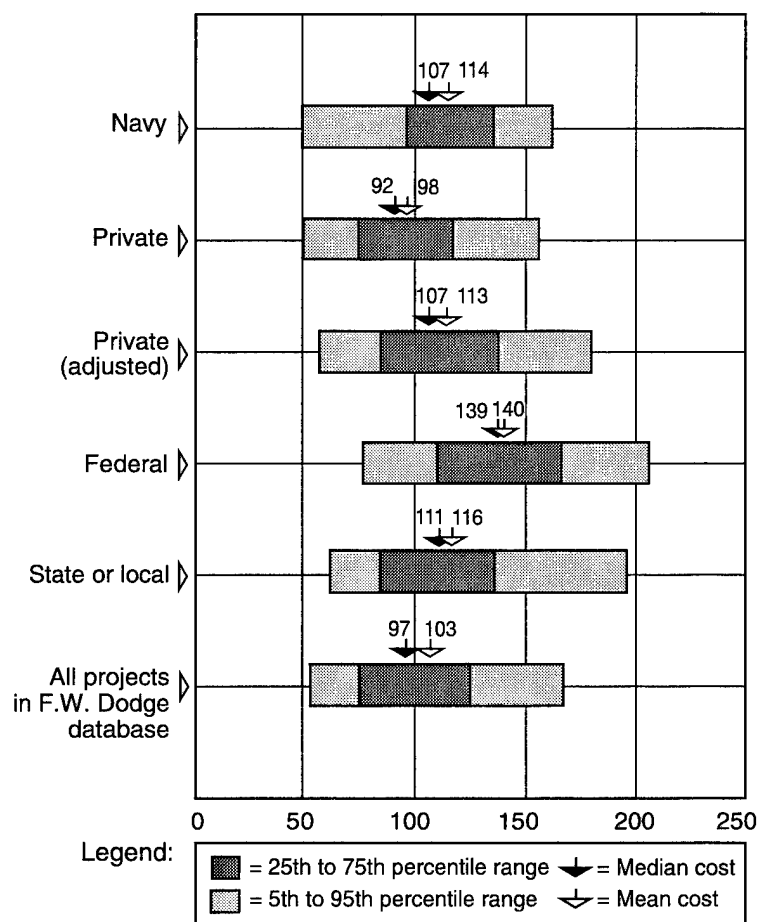
*Figure 3-2. Construction Costs of Bachelor Enlisted Quarters
(FY97 dollars per square foot)*



Child Development Centers

Figure 3-3 compares the construction costs of child development centers. The construction costs of Navy centers are higher than those of similar facilities built by the private sector, comparable to those of similar facilities owned by state and local governments, and considerably lower than the costs of such facilities owned by other federal agencies.

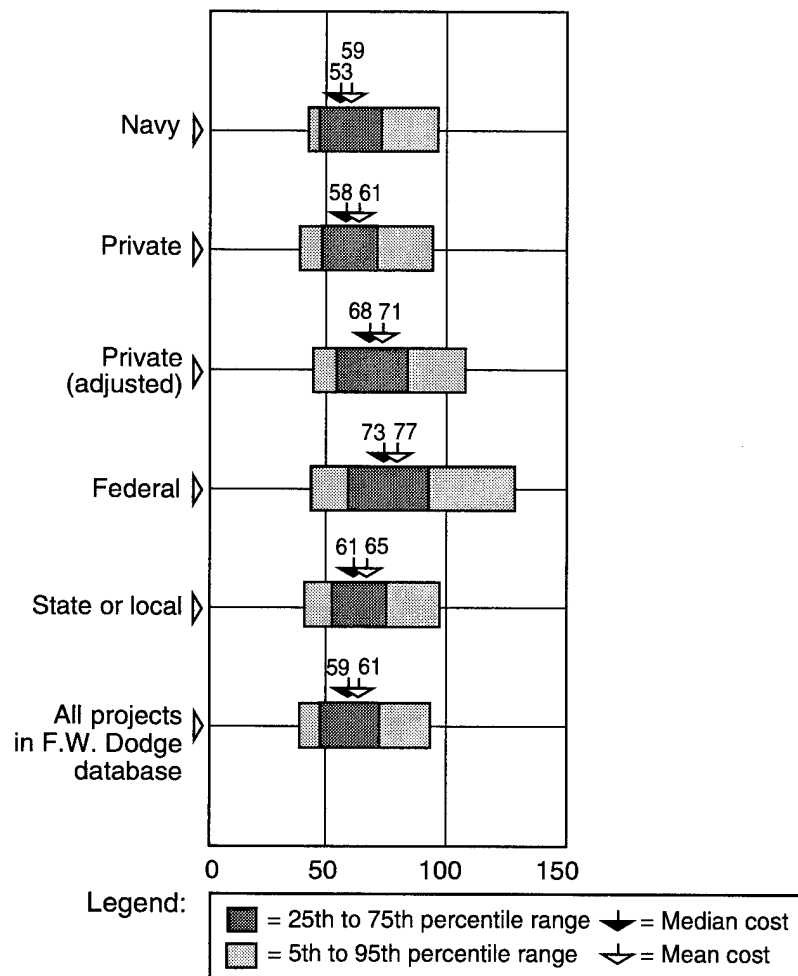
*Figure 3-3. Construction Costs of Child Development Centers
(FY97 dollars per square foot)*



Family Housing

Figure 3-4 compares the construction costs of family housing. The construction costs of Navy family housing are lower than those of housing built by all other owners. (The number of Navy family housing projects in the sample size is extremely low. Additionally, both the Navy and the Dodge databases comprise projects rather than individual housing units. While NAVFAC identifies the number of housing units in each project, the Dodge database does not. Therefore, we were unable to weight the average costs per square foot by the number of units per project to account for efficiencies of size. We do not believe, however, that this limitation invalidates the comparison.)

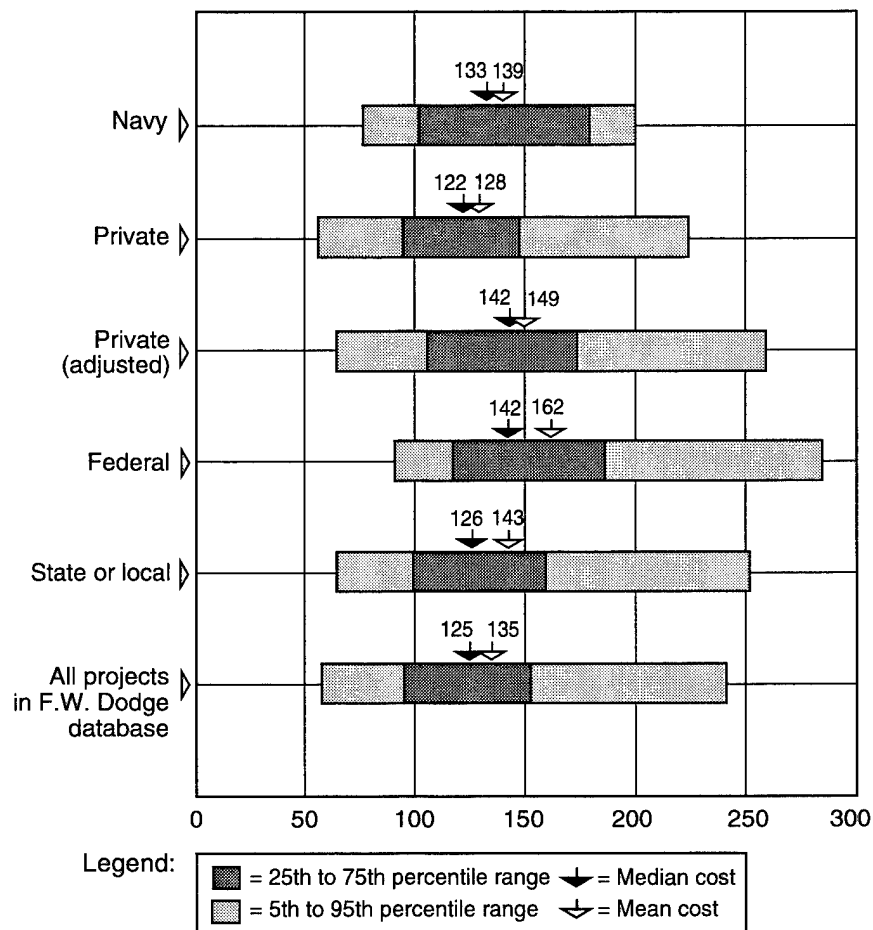
*Figure 3-4. Construction Costs of Family Housing
(FY97 dollars per square foot)*



Fitness Centers

Figure 3-5 compares the construction costs of fitness centers. The construction costs of Navy fitness centers are somewhat higher than those of similar facilities built by the private sector, comparable to those built by state and local governments, and lower than the costs of such facilities owned by other federal agencies.

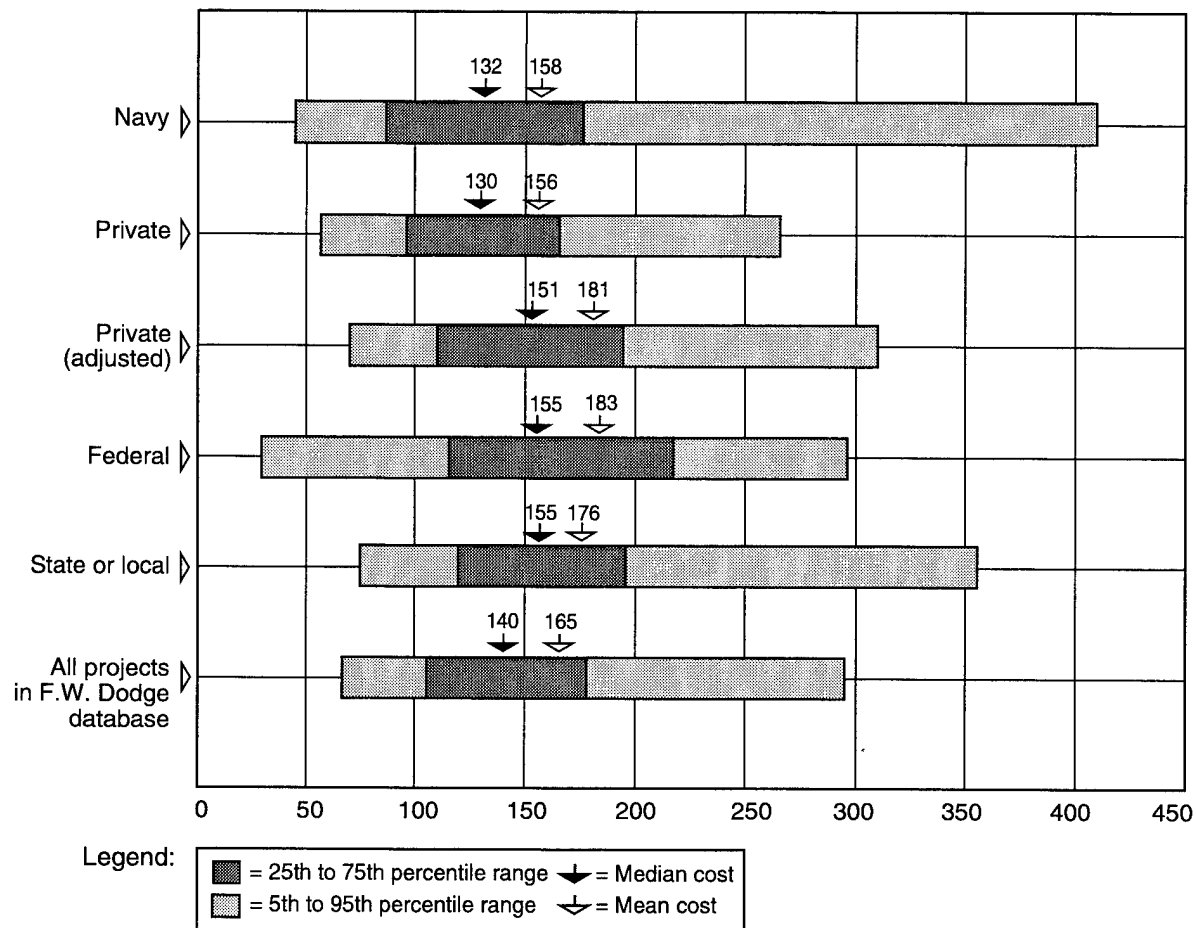
*Figure 3-5. Construction Costs of Fitness Centers
(FY97 dollars per square foot)*



Laboratories

Figure 3-6 compares the construction costs of laboratories. The construction costs of Navy laboratories are generally comparable to those of laboratories built by the private sector and significantly less than the costs of laboratories owned by federal agencies and by state and local governments. This finding is limited by the small number of Navy laboratories (23) in the sample.

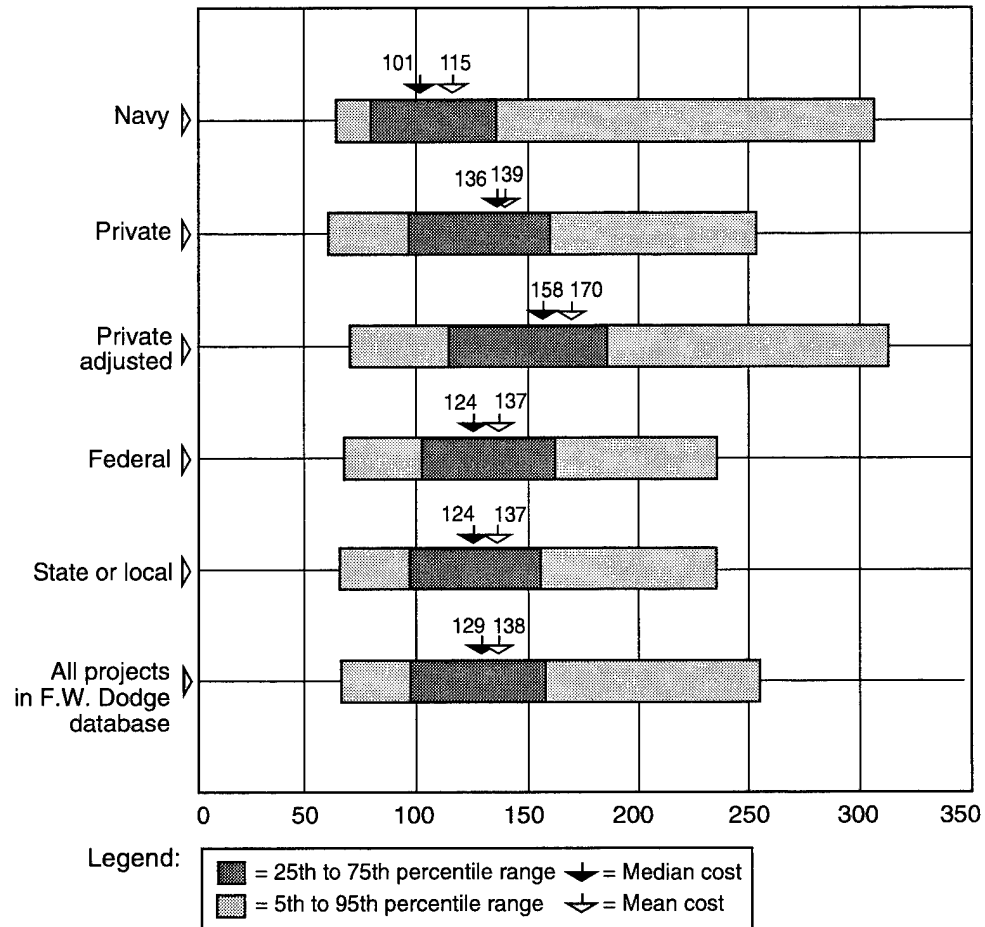
*Figure 3-6. Construction Costs of Laboratories
(FY97 dollars per square foot)*



Training Facilities

Figure 3-7 compares the construction costs of training facilities. The construction costs of Navy training facilities are significantly less than those of similar facilities built by any other owner.

*Figure 3-7. Construction Costs of Training Facilities
(FY97 dollars per square foot)*



Summary

Table 3-1 shows the actual cost per square foot at the 5th, 25th, 75th, and 95th percentiles for each category of facility that we analyzed and for each type of owner. It also shows the median and mean construction costs per square foot. The last column shows the costs for all projects in the Dodge database.

*Table 3-1. Median and Mean Construction Costs by Facility Category and Owner
(FY97 dollars per square foot)*

Facility category	Navy	Projects in F.W. Dodge database				
		Private	Private (adjusted)	Federal	State or local	Total
Administrative facilities						
5th percentile	54.80	50.94	59.09	63.63	52.27	51.07
25th percentile	87.68	85.91	99.66	95.93	86.04	86.09
75th percentile	118.45	119.41	138.52	171.45	138.97	120.33
95th percentile	140.56	171.39	198.81	258.75	214.84	177.59
Median	103.09	104.22	120.90	122.35	106.97	104.45
Mean	103.07	106.82	123.91	144.79	124.61	108.25
Bachelor enlisted quarters						
5th percentile	65.53	47.67	55.30	71.20	62.99	47.98
25th percentile	75.54	69.49	80.61	102.31	81.50	71.22
75th percentile	98.20	108.48	125.84	154.57	126.51	112.45
95th percentile	147.20	171.16	198.55	238.59	212.05	176.45
Median	85.14	86.02	99.78	121.36	99.18	87.76
Mean	90.44	96.94	112.45	145.74	131.88	100.95
Child development centers						
5th percentile	50.05	50.28	58.32	77.92	60.75	52.08
25th percentile	97.15	71.50	82.94	109.54	85.13	74.31
75th percentile	135.83	118.06	136.95	166.58	136.65	122.88
95th percentile	160.97	156.19	181.18	204.87	196.15	168.61
Median	107.11	91.98	106.70	138.72	111.20	97.03
Mean	114.13	97.56	113.17	140.26	115.77	102.82
Family housing						
5th percentile	40.60	37.12	43.06	41.59	39.93	37.19
25th percentile	46.40	47.76	55.40	57.95	52.37	47.88
75th percentile	74.00	71.84	83.33	89.85	75.17	71.99
95th percentile	95.60	93.07	107.96	129.20	97.16	93.25
Median	53.00	58.81	68.22	73.21	61.04	58.89
Mean	59.06	60.97	70.73	77.44	65.36	61.14

*Table 3-1. Median and Mean Construction Costs by Facility Category and Owner (Continued)
(FY97 dollars per square foot)*

Facility category	Navy	Projects in F.W. Dodge database				
		Private	Private (adjusted)	Federal	State or local	Total
Fitness centers						
5th percentile	77.06	56.01	64.97	90.51	64.62	59.16
25th percentile	101.12	93.52	108.48	118.38	99.03	96.55
75th percentile	178.66	147.51	171.11	187.23	157.93	152.35
95th percentile	199.63	223.29	259.02	283.65	262.40	242.26
Median	133.13	122.01	141.53	141.77	126.47	124.55
Mean	138.54	128.44	148.99	162.07	142.99	134.98
Laboratories						
5th percentile	44.38	56.96	66.07	78.94	77.41	66.15
25th percentile	87.85	95.41	110.68	117.90	119.68	103.88
75th percentile	176.77	165.20	191.63	218.49	196.85	179.44
95th percentile	405.76	267.22	309.98	297.22	355.63	295.64
Median	131.71	129.85	150.63	154.51	154.70	139.66
Mean	158.32	155.60	180.50	183.47	176.12	165.08
Training facilities						
5th percentile	54.40	59.77	69.34	66.97	66.63	63.61
25th percentile	80.29	97.00	112.64	91.04	97.82	96.69
75th percentile	135.81	159.35	185.41	162.02	154.25	156.97
95th percentile	217.46	252.92	312.16	233.53	244.21	245.69
Median	100.98	136.06	157.85	124.13	124.11	128.62
Mean	115.07	139.36	170.40	137.01	137.03	137.98

CONCLUSIONS

Given our findings, we conclude that the costs of facilities constructed under Navy contracts compare favorably to private-sector construction costs for similar facilities. More specifically, our data show the following:

- ◆ The Navy's median and mean construction costs for training facilities are considerably lower than those of the private sector.
- ◆ The Navy's costs for family housing are lower than those of any other owner.

- ◆ The Navy's costs for administrative facilities, BEQs, and laboratories are comparable to those of the private sector.
- ◆ The Navy's costs for fitness centers are higher than those of the private sector but are lower when private-sector costs are adjusted to reflect the cost of complying with federal contracting requirements.
- ◆ The Navy's costs for child development centers are higher than those of the private sector but are comparable when private-sector costs are adjusted to reflect the cost of complying with federal contracting requirements.

Not only are the Navy's construction costs comparable to those of the private sector, but they are lower than those of other federal agencies and of state and local governments.

Appendix

Construction Cost Adjustment Factors

We normalized the cost of each project in our database to account for regional price differences, size differences, and inflation. This appendix describes our adjustment factors.

GEOGRAPHIC LOCATION

We adjusted the costs of all projects to reflect differences in costs of construction materials and installation, including labor and equipment rentals, in different areas of the country. To make those adjustments, we used the Means city cost indexes (CCIs).¹ The CCIs are construction cost indexes for 655 U.S. cities listed by zip code and are recognized as the industry standard. The CCI is the ratio of a specific city's cost to a national average cost; the national average cost is calculated using the construction costs in 30 major U.S. cities. (NAVFAC traditionally adjusts its project costs using the most current DoD area cost factors, or multipliers, for specific military installations. We did not use DoD's multipliers because they are not representative of the larger civilian marketplace.)

SIZE

In general, the cost per square foot to build a small facility is relatively high compared with a typical facility, and the cost per square foot to build a large facility is relatively low (due to increased efficiencies). Therefore, we adjusted the costs of all projects in our database, except for family housing projects, so that they would reflect the costs for a typical facility. DoD determines typical facility sizes annually.² Typical facility sizes determined by DoD are shown in Table A-1.

¹ R.S. Means, *Facilities Construction Cost Data*, 12th Annual Edition, 1997.

² Memorandum from the Office of the Under Secretary of Defense for Acquisition and Technology, Subject: *Revised Area Cost Factors for FY 1997 through FY 1999 Department of Defense Construction Programs*, 28 August 1996.

*Table A-1. Typical Facility Sizes
(gross square feet)*

Facility category	Typical size
Administrative buildings	25,000
Bachelor enlisted quarters	99,500
Child development centers	15,000
Family housing	NA ^a
Fitness centers	20,000
Laboratories	25,000
Training facilities	25,000

^a DoD does not determine a typical size for family housing.

To make the adjustment, we applied a size factor to each project. We calculated the size factor using the following equation:

$$\text{Size factor} = 0.89150 + 0.24564(X + 0.65405)^{-1.5583},$$

where X represents the ratio of the actual facility size to the typical facility size.

The equation was developed from a size adjustment chart published by NAVFAC.³

INFLATION

We adjusted all project costs to FY97 price levels to account for differences caused by inflation. For the adjustment, we used the DoD MILCON and family housing deflators, which are established each year by the Office of the Under Secretary of Defense (Comptroller).⁴ The FY97 deflators are shown in Table A-2.

³ Naval Facilities Engineering Command, *Cost Engineering: Policy and Procedures*, Military Handbook 1010-A, 1 August 1992, Figure 8, p. 23.

⁴ Office of the Under Secretary of Defense (Comptroller), *National Defense Budget Estimates for FY 1997*, April 1996, Table 5-4, p. 42.

Table A-2. FY97 MILCON and Family Housing Deflators

Project year	MILCON deflators	Family housing deflators
FY87	76.02	75.98
FY88	79.27	78.37
FY89	82.41	81.47
FY90	85.31	84.40
FY91	87.73	88.10
FY92	89.80	90.08
FY93	91.69	92.09
FY94	93.65	94.03
FY95	95.64	95.80
FY96	97.77	97.83
FY97	100.00	100.00

REPORT DOCUMENTATION PAGE

Form Approved
OPM No.0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources gathering, and maintaining the data needed, and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)		2. REPORT DATE Sep 97	3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE Comparison of Navy and Private-Sector Construction Costs			5. FUNDING NUMBERS C DASW01-95-C-0019 PE 0902198D	
6. AUTHOR(S) Jordan W. Cassell, Robert D. Campbell, Paul D. Jung				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Logistics Management Institute 2000 Corporate Ridge McLean, VA 22102-7805			8. PERFORMING ORGANIZATION REPORT NUMBER LMI- NA610T1	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Jim Bartlett Naval Facilities Engineering Command 200 Stovall Street Alexandria, VA 22332			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT A: Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Each year, the Department of the Navy, through the Naval Facilities Engineering Command, contracts for military construction projects at a cost exceeding \$2 billion. Congressional committees and Navy customers have expressed concern about whether the costs of facilities constructed under NAVFAC contracts are comparable to private-sector construction costs. This report compares those costs. The report includes a description of the methodology used to ensure that the comparisons were valid. The study focused on analyzing comparable types of facilities and properly accounting for the additional costs of complying with federal contracting requirements as compared with the costs of similar projects completed under typical private-sector contracts. The study found that the costs of facilities constructed under Navy contracts compare favorably to private-sector construction costs for similar facilities. Moreover, the Navy's construction costs are lower than those of other federal agencies and of state and local governments.				
14. SUBJECT TERMS Naval Facilities Engineering Command, MILCON, construction costs, military construction, NAVFAC			15. NUMBER OF PAGES 26	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	